Chapter 2

Problems from Nonpoint Source Pollution

Nonpoint pollution is generally regarded as a local land use issue that has far-ranging effects. Land use activities benefit the economy in both the long and short term, but some of them are the primary contributors to nonpoint source pollution. Resolving the dilemma between the economy and the environment is not easy.

The Washington State Legislature defined nonpoint pollution as:

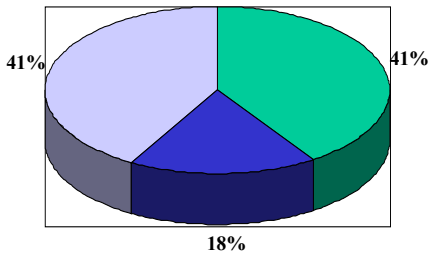
> " pollution that enters any water of the state from any dispersed water-based or land-use activities, including, but not limited to, atmospheric deposition, surface water runoff from agricultural lands, urban areas, and forest lands, subsurface or underground sources, and discharges from boats or other marine vessels." (RCW 70.146.020(8))

Water quality data is available from rivers, lakes, estuaries and ground water in Washington. The quality and quantity of this data are highly variable due to many factors. Each of these systems are typically impacted by different sources of pollution and types of pollutants. This too is highly variable, mostly due to land use differences. The following discussion looks at the four water systems and evaluates the primary nonpoint source pollution issues for each.

Rivers

Many different water quality problems affect rivers and streams in the state. Approximately 65 percent of the total rivers and streams assessed are not fully supporting their beneficial uses. These range from large lowland rivers draining agricultural and urbanized areas to small streams in forested areas.

Figure 2.1
Condition of Washington's Streams



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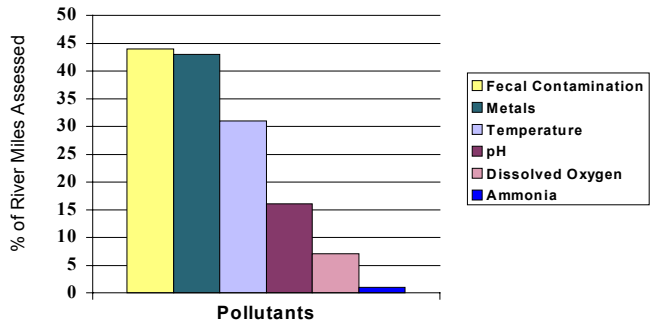
The primary causes of water quality problems are fecal contamination, metals, temperature, pH and dissolved oxygen. Siltation and other habitat modifications are

significant issues as well. With the exception of metals pollution, these are all indicators of nonpoint source pollution. These problems affect the use of rivers and streams for swimming, support of aquatic life, and wildlife habitat. The graph below shows the major causes impairing beneficial uses in the state's rivers and streams.

Figure 2.2
Pollutants Causing Impairment

All Streams Assessed in Washington



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Impacts from various land uses are slowly changing. In the forested environment, forest practices rules focusing on preventing water quality problems have been in place since the early 1980s. These rules have been modified over time to provide what is generally recognized as the most restrictive protection found in any state in the country. Forested areas have been the site of many restoration efforts. Though change occurs slowly in the forest, the indication is that forested streams will gradually improve over time.

In agricultural areas, practices are also improving. Educational efforts by the Natural Resources Conservation Service, conservation districts, and WSU Cooperative Extension have raised awareness of producers and increased the number of acres managed under best management practices (BMPs). Nutrient management on dairy farms continues to be a tough issue, along with soil erosion from dryland and irrigated crops. But progress is happening, and in many areas we expect to see the fruits of this work showing up as cleaner water. It will be important for the agricultural community to assess the changes and demonstrate water quality improvements so people will be aware of them.

The difficult places in the state are on the urban fringes. Data from a variety of studies now shows that aquatic ecosystem integrity and the ability to support fish life (a beneficial use) are impaired when the impervious surface of a watershed exceeds very low levels. Since most of the development in the state is occurring on the urban fringe, the total acreage of agricultural and forest land is being depleted. With that loss comes the inevitable degradation of water quality.

The greatest impacts associated with urban development are from altered peak flows in the winter and reduced base flows in the summer. Runoff from impervious surfaces also

delivers nutrients, sediment, fecal contamination and toxic chemicals to stream systems. Stormwater management is a problem for many towns. Future development using today's BMPs will continue to exacerbate the situation.

The public's understanding of the value of river systems in Washington continues to increase. Rivers are seen as much more than simply a source of power or water. Issues related to salmon survival highlight the magnitude of water quality, flow, and habitat problems. Conflicting uses have resulted in a need for more comprehensive planning that considers a wide range of interests. Population growth has had a disturbing impact on water availability that in turn impacts the quality of the water in streams and rivers. New information about ground water-surface water interaction has opened a whole new aspect to management decision making.

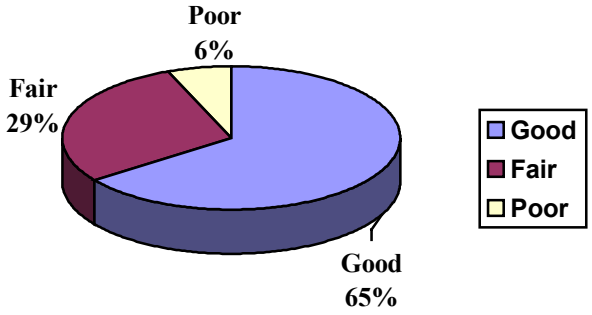
Lake Health

One of the most sought-after housing sites in Washington is on the shoreline of a beautiful, clear lake. Many of the lakes of Washington have what people want - an aesthetically pleasing setting, quality recreation and fishing conditions, a healthy habitat for fish and wildlife and good water quality. Those lakes with poor water quality may be due to natural conditions, but generally the culprit has been man's own activities in the watershed. Excessive loading of phosphorus, both external and internal, almost always causes the excessive algal concentrations that indicate poor water quality.

In nearly all cases, watershed developments with associated runoff from roofs, streets, sidewalks, and lawns are the main sources of phosphorus which eventually ends up in lakes. As sediments accumulate, in-lake recycling of phosphorus can become the dominant source that feeds excessive blooms of algae. In extreme cases, cyanobacteria (blue-green algae) can severely degrade the lake uses. Development of lake-watersheds is an ever-increasing threat to lakes' health as our population grows. The following figure shows that 35 percent of monitored lakes are in less than good condition. Many are in high-density housing areas.

Figure 2.3

Condition of Washington's Lakes



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Aquatic plant management can be a most confusing issue when examining the health of a lake. Many lake residents do not understand that most healthy lakes, especially if shallow, will naturally have an abundant and diverse population of aquatic plants. To many lakeside residents, abundant plant growth must be removed to improve access, recreation and aesthetics. Often, a comprehensive lake education program will help lakeshore owners realize that natural riparian zones and aquatic plant communities are essential for a healthy lake.

Estuaries and the Nearshore

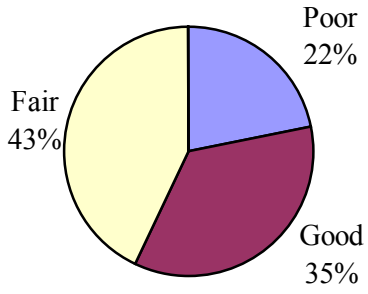
The tidal, sheltered waters of estuaries where fresh and salt water mix support unique communities of plants and animals, specially adapted for life at the margin of the sea. Estuarine environments are among the most productive on earth, creating more organic matter each year than comparably-sized areas of forest, grassland, or agricultural land. Many different habitat types are found in and around estuaries, including shallow open waters, freshwater and salt marshes, sandy beaches, mud and sand flats, rocky shores, oyster reefs, mangrove forests, river deltas, tidal pools, sea grass and kelp beds, and wooded swamps.

The nearshore environment includes the beach, intertidal and shallow subtidal areas. These habitats are critical to the health of estuaries and marine life. They provide shelter for fish, shellfish, birds, and marine mammals. They're used as spawning, rearing and feeding grounds for species that live in and around the shoreline. The nearshore is a variety of habitats, from mudflats to eelgrass beds and salt marshes. Each is significant for supporting some aspect of the salmon life cycle.

Salmon are very small when they leave streams and enter estuaries and other nearshore environments. They use the nearshore as their travel corridor to the ocean and their chance to grow, eating large quantities of forage fish such as sand lance, surf smelt, herring and other small marine animals until they get big enough to move out into deeper waters.

The nearshore is also home to an abundance of small marine invertebrates. Surf smelt spawn directly in gravel on the beach near the high water mark. Herring lay their eggs on eelgrass and raise their young in eelgrass beds. Eelgrass beds occur in shallow and generally calm marine waters and are sensitive to human disturbance.

Figure 2.4
Condition of Washington's Estuaries



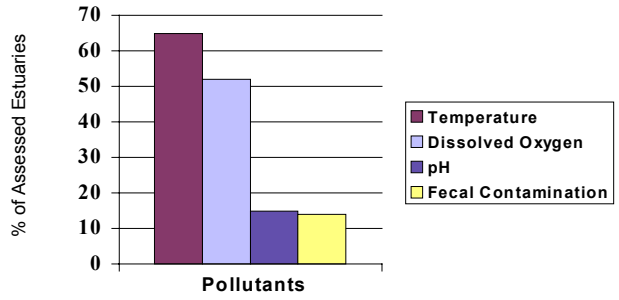
Estuaries are critical for the survival of many species. Tens of thousands of birds, mammals, fish, and other wildlife depend on estuarine habitats as places to live, feed, and reproduce. Estuaries provide ideal spots for migratory birds to rest and refuel during their journeys. And many species of fish and shellfish rely on their sheltered waters as protected places to spawn, giving them the nickname "nurseries of the sea." Hundreds of marine organisms, including most commercially valuable fish species, depend on estuaries at some point during their development.

Among the benefits of estuaries are recreation, scientific knowledge, education, and aesthetic values. Boating, fishing, swimming, surfing, and bird watching are some of the recreational activities people enjoy there. Estuaries are often cultural centers for coastal communities, serving as focal points for local commerce, recreation, celebrations, customs, and traditions. As transition zones between land and water, estuaries are valuable laboratories for scientists and students, providing lessons in biology, geology, chemistry, physics, history, and social issues. Estuaries also give aesthetic enjoyment for the people who live, work, or recreate in and around them.

The economic benefits of estuaries should not be overlooked. Tourism, fisheries, and other commercial activities thrive on their wealth of natural resources. Estuaries serve as harbors and ports for shipping, transportation, and industry.

Some of the impacts to estuaries are caused by upland development which can easily pollute the nearshore with bacteria, excess nutrients and toxics, making shellfish unsafe for eating and water unsafe for swimming. Temperature and dissolved oxygen problems shown below are largely due to natural conditions.

Figure 2.5
Pollutants Causing Impairment
of All Estuaries Assessed in Washington



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Direct physical alteration of the nearshore occurs with the construction of bulkheads, rip rap, docks, piers, and other waterfront features. These can affect the character of the beach and shallow water areas and cause the loss of some habitats, including baitfish spawning areas and eelgrass beds.

Ground Water in Washington State

In Washington, ground water provides more than 65 percent of the drinking water consumed by its 5.6 million residents. Ground water constitutes over 25 percent of the total water used for drinking, industrial, commercial, and agricultural purposes. Given the importance of ground water to public health and economic development, it is vital that this resource be protected and managed for current and future beneficial uses.

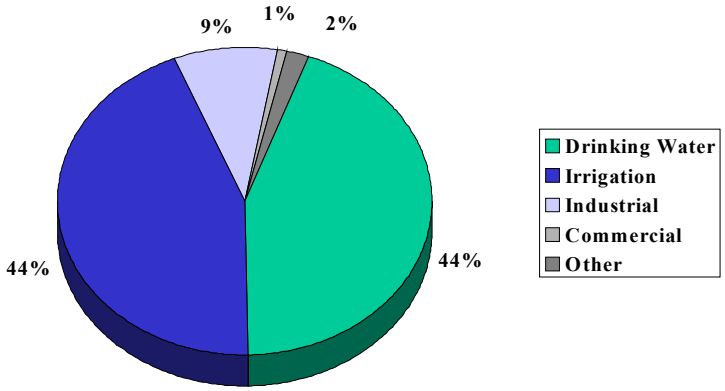
There are approximately 16,000 ground water dependent drinking water supply systems in the state. These systems constitute over 95 percent of the public water supply systems. Private wells are estimated at 404,000, serving 1,000,000 residences located primarily in rural areas.

Ground water contributes significantly to our surface water bodies. It is estimated that baseflow contribution for streams is 70 percent. Protection of the State's ground water resources is vital in maintaining instream flows and water quality in the state's streams and lakes during summer months. A major concern for the State is the expected increased demand on ground water as the population grows from current levels to an estimated 11 million by the year 2045.

Washington has some of the most productive aquifers in the nation. The largest is the Columbia River Basalt Aquifer System located within 13,000 square miles of the central portion of the state. Two smaller but vital aquifer systems serve the Spokane and Puget

Sound areas (the Spokane-Rathdrum Prairie Aquifer and the Puget Sound aquifer system). Well yields in all three of these systems are substantial.

Figure 2.6
Groundwater Use in Washington



Generally, ground water quality in Washington is good. However, there do exist several areas of degraded ground water where beneficial use has been negatively impacted. These include areas of elevated nitrate within the Columbia Basin, elevated nitrate and EDB in Whatcom County, and TCE and metals in areas of Clark County. Currently the State has identified 22 CERCLA (Superfund) sites, 10 RCRA corrective action sites, and over 100 sites currently being managed under the State's Model Toxics Control Act.

Ground water contamination due to nonpoint sources appears to be the most significant threat to ground water quality. Nitrate contamination of the State's aquifers is the most widespread problem encountered to date. Statewide, exceedances of the 10mg/l nitrate-nitrogen drinking water standard in private/domestic wells are estimated at 10-15 percent, with a few areas as high as 20-25 percent. A recently-completed study by the Washington State Department of Health in conjunction with the USGS indicated that of 1,326 Class A public water supply wells sampled, no violations of maximum contaminant levels (MCL's) were detected for pesticides. Low levels of pesticides were detected in approximately six percent of a subgroup (1,103) of these wells.

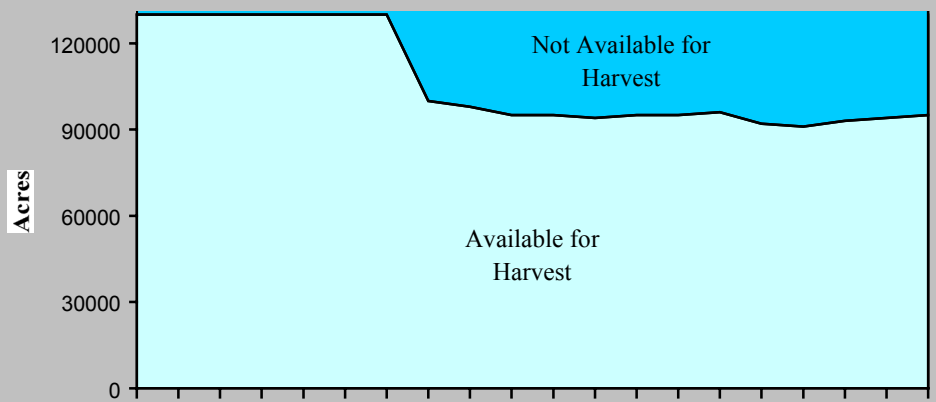
Single family domestic (private) wells are classically at higher risk from nitrate contamination than municipal wells. Private wells are typically more shallow than municipal wells and are often located in closer proximity to potential contaminant sources such as septic tanks, agricultural areas or concentrated animal operations. The statewide percentage of private wells exceeding the nitrate standard may well be 10-15 percent as referenced above, but DOH lacks sufficient statewide data to support this figure.

Shellfish Harvesting

Commercial Shellfish

Department of Health's Office of Food Safety and Shellfish Programs is responsible for issuing licenses and certification to over 350 commercial shellfish operations. A variety of species is harvested commercially in Washington's Puget Sound and coastal regions, including oysters, clams, and mussels. Since these species are filter feeders capable of concentrating chemicals, bacteria, viruses, or marine biotoxins, ongoing evaluations of pollution sources and water quality in the harvest areas are essential.

Figure 2.7
Commercial Shellfish Beds in Puget Sound



Recreational Shellfish

Department of Health's Recreational Shellfish Program provides information about where and how to safely harvest shellfish that are free of contamination. To achieve this goal the department classifies beaches by locating potential shoreline pollution sources and evaluating water quality for bacteria. The department also monitors beaches for biotoxin (PSP). Pollution sources can be more long term, chronic problems. Beach classifications reflect local pollution conditions.

Water Quality Assessment in Washington

Ecology continually assesses the quality of the waters of the State to see if water quality standards are being met and if beneficial uses are being protected. Data to support this assessment come from many sources inside and outside the agency. This information is then reported semi-annually to EPA in the 305(b) Report, named after section 305(b) of the Clean Water Act.

Baseline Monitoring

Baseline monitoring determines current conditions in a water body or aquifer. It is often associated with planning activities and focused on a watershed or geographic area. Planning activities include nonpoint source pollution controls, TMDLs, ground water protection, or any of the other planning activities identified in Chapter 6. Approximately half the State's surface waters and vast majority of ground waters have not been monitored and need baseline data. Over the next 15 years, the goal is to get baseline data for both surface and ground water at the rate of an additional two percent of the state's waters per year.

Ambient Monitoring

Ecology's Environmental Assessment Program (EAP) currently has an ambient monitoring program to assess the current status of state surface waters, identify threatened or impaired waters, and evaluate trends in water quality over time. This is accomplished through a statewide network of sampling stations in rivers, streams, lakes, and marine waters (Puget Sound and coastal estuaries). To maximize coverage and reduce costs, sampling stations are located in coordination with other state, local, and federal agencies. By detecting early changes, ambient monitoring allows simpler, less expensive solutions to emerging problems.

The objectives of the ambient monitoring program are:

- to provide analytical water quality information which describes present conditions and changes in water quality and which discusses the impacts of these conditions on the aquatic resource
- to provide data with which TMDL models may be refined and verified and for other site-specific water quality issues
- to provide data to evaluate impairment of beneficial uses and detect violations of State water quality standards

The surface water ambient monitoring program has approximately 82 river and stream stations, 40 marine water stations, 100 sediment monitoring stations, and 74 lakes. The program also coordinates volunteer monitoring of approximately 65 lakes using over 75 volunteers. The data is stored at Ecology, but is available to anyone requesting it. The program typically fills over 200 requests for data per year.

Another monitoring program in Washington is the Puget Sound Ambient Monitoring Program (PSAMP). One of its goals is to measure the success of implemented programs. It is a long-term effort to comprehensively monitor and assess the condition of the Puget Sound ecosystem. The Puget Sound Action Team coordinates ambient monitoring activities in the Sound by federal, state, tribal, and local agencies. There are many other ambient monitoring activities in the State. Tribal and local entities regularly monitor waters in their jurisdiction or surrounding areas.

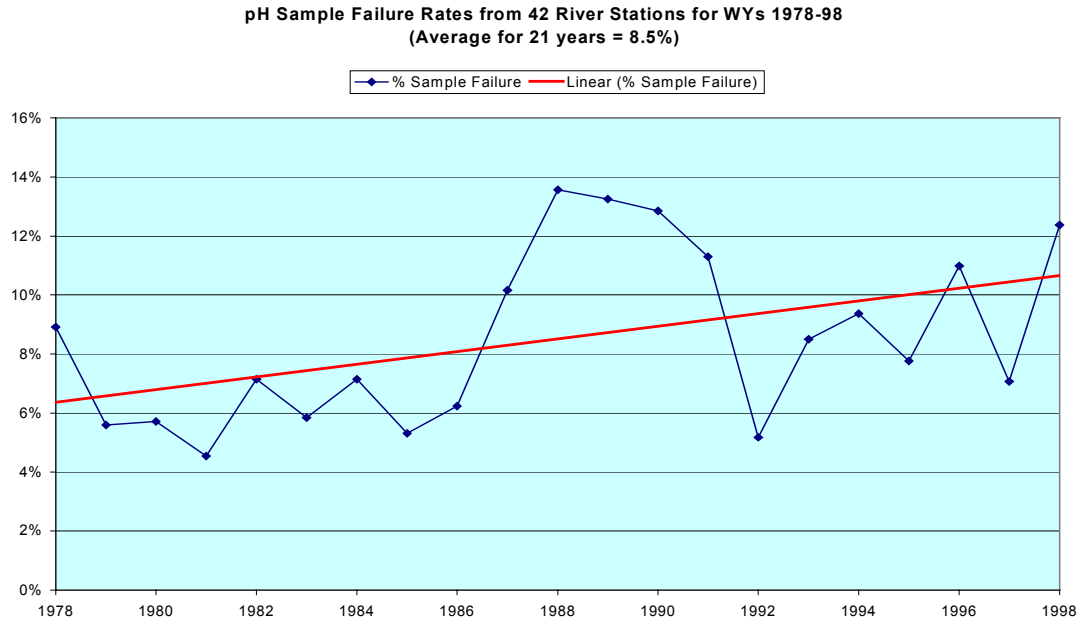
In 1998, directors of the Departments of Ecology, Health, Agriculture, and Conservation Commission declared that there was value in investigating the possibility of establishing a statewide ambient ground water monitoring system similar to those established in numerous other states. In 2000 this investigation will begin through use of the Interagency Ground Water Committee and in coordination with the U.S. Geologic Survey and the U.S. Environmental Protection Agency. Ultimately, the goal will be to establish an ambient monitoring system to track trends in ground water quality (305(b) Report), and to use as a measure of progress for regional and statewide ground water protection initiatives.

Evaluating Water Quality Change through Violation History

Ecology's Water Quality Program has evaluated statewide ambient monitoring data from EAP to show the number of violations of water quality standards over time. Even though the data does not represent a valid trend analysis, the information is indicative of water quality improvements or further degradation. Ecology has been using a water quality index for pH, dissolved oxygen, temperature, and fecal contamination, to show percent failure rate of samples collected over a 20-year period. Percent failure is the number of samples that fail to meet the standard, divided by the total number of samples. The resultant number shows an indication of whether the State's waters are improving or declining. Linear indication lines have been added to each index to show overall tendency, but statistical trend analysis has not yet been completed.

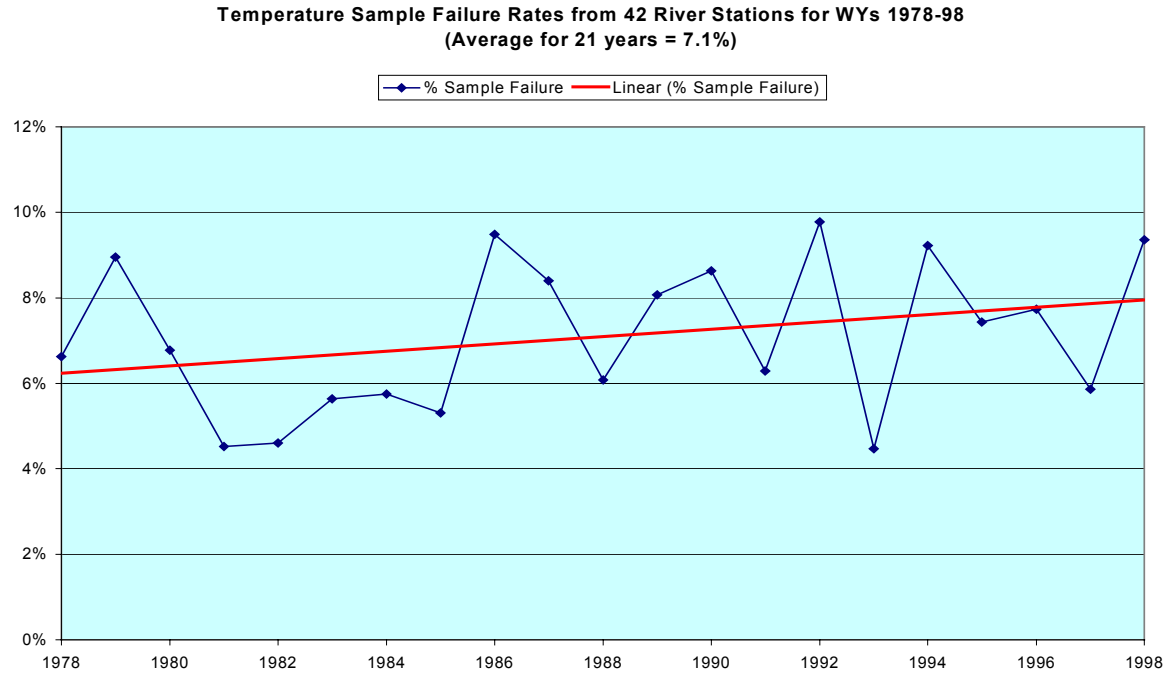
The following charts show data from 42 of those monitoring stations analyzed for specific water quality parameters over the past 20 years. Temperature has shown a nearly two percent increase in sample failure rate.

Figure 2.7 pH Sample Failure Rates



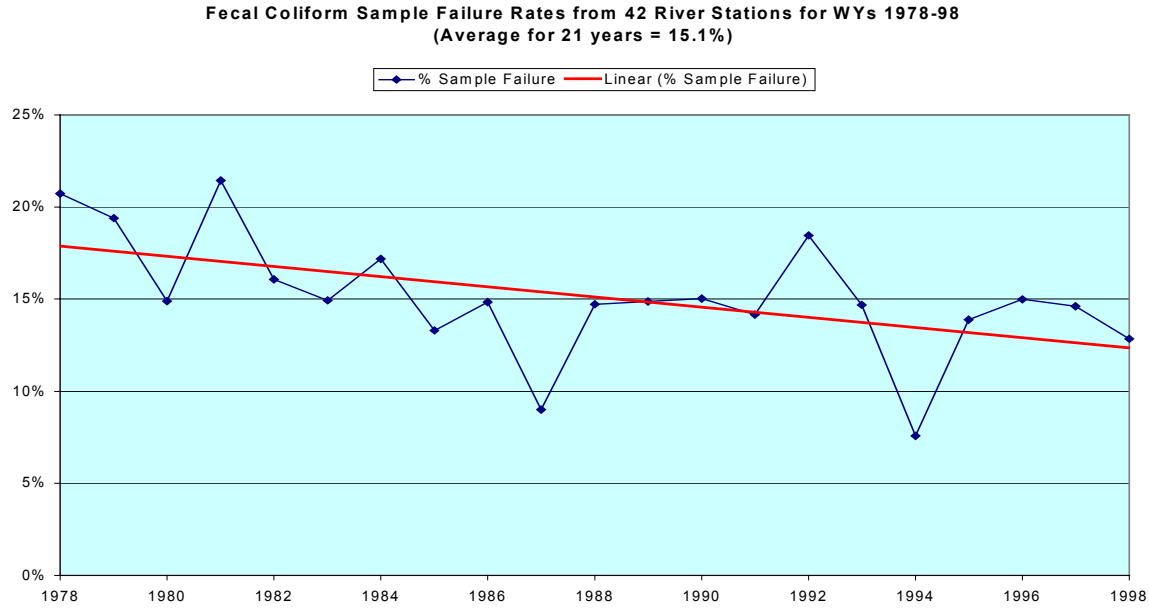
The failure rate of attaining pH standards has increased nearly four percent over the last 20 years.

Figure 2.8 Temperature Sample Failure Rates



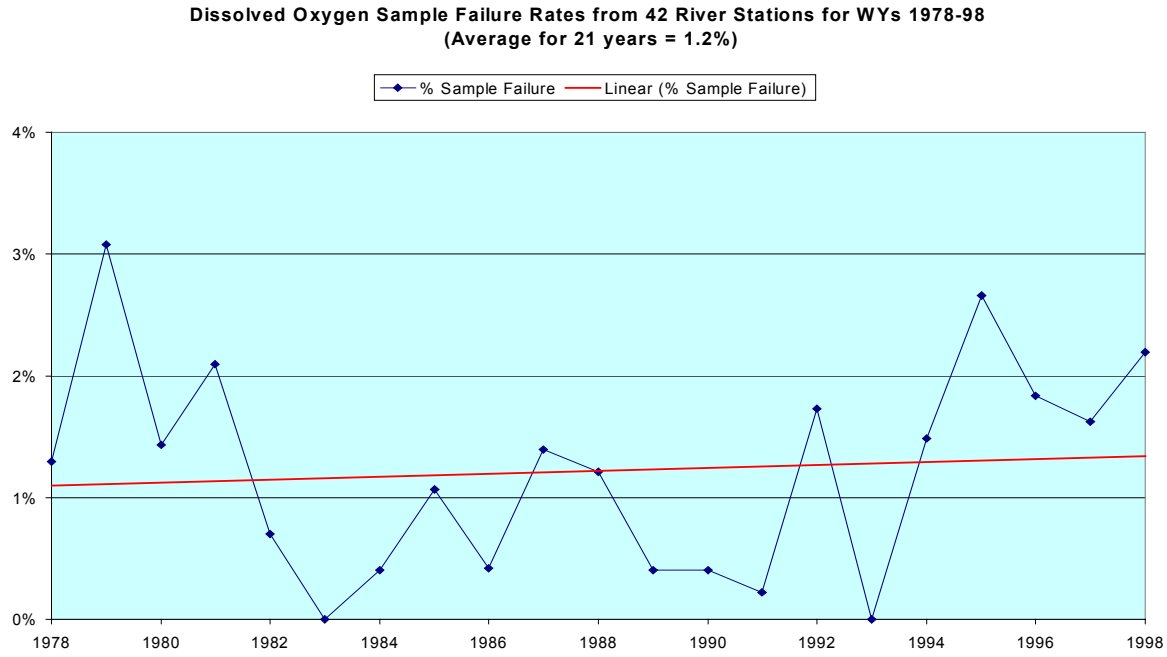
Temperature has shown a nearly 2% increase in sample failure rate.

Figure 2.9 Fecal contamination Failure Rate



Fecal contamination is the only parameter of the four that has shown a decline in sample failure, nearly five percent.

Figure 2.10 Dissolved Oxygen Sample Fail Rate



Dissolved oxygen has increased in sample failure rate, although the rate is less than one percent.

The State intends to develop data on several other parameters typically measured for nonpoint source pollution. Indices will be developed for flow, total suspended solids, pesticides, and nutrients. An effort will be made to develop these water quality indices for all 62 water resource inventory areas. However, a single statewide index will be developed first.

Project Monitoring

The Environmental Assessment Program also monitors surface waters on a project or site-specific basis. The types of projects include **Total Maximum Daily Load (TMDL) studies** conducted on rivers, lakes, and marine waters which do not meet state water quality standards. Technical assessments are made for all or part of a watershed and typically have both a field sampling and an analytical (modeling) component. Assessments quantify loading from both point and nonpoint sources and frequently include studies describing the relationship between surface water and ground water quality.

These assessments calculate the total maximum daily load (TMDL) allowed of a pollutant that the water body can absorb without causing violations of water quality standards. The reduction in loading that would be necessary to return the river, lake, or estuary to a condition of acceptable water quality is estimated, and alternative scenarios for pollutant load reduction which may be implemented by Ecology and local partners are explored.

Other entities in Washington are engaged in water quality monitoring activities.

1. Washington State Department of Health is mandated by state law to classify commercial shellfish beds to protect shellfish consumers from contaminated shellfish. To meet part of the legal mandate, DOH continually monitors fecal contamination levels in more than 100 classified (restricted) commercial shellfish growing areas in Puget Sound.

2. Washington state tribes regularly monitor for water quality effects on fish habitat. In addition, tribes are often called upon to technically assist in water quality monitoring for local watershed planning efforts.

3. Local jurisdictions including conservation districts monitor for local watershed planning. They also monitor for impacts from onsite sewage disposal, effects of farm practices, and impacts from local land uses.

4. Washington State University and University of Washington consult with local jurisdictions and provide monitoring expertise. For example, the Water Research Center on the WSU campus has a long history of providing monitoring reports for local planning efforts, especially watershed planning and lake restoration planning.

5. With Ecology, the Governor's Council on Environmental Education has developed a program for citizen participation in environmental monitoring. The program, Watch Over Washington, supports local groups through a website where news, tips, and success stories are posted. It is estimated that more than 12,000 citizens and students in Washington are involved in monitoring our natural resources. The current emphasis on volunteer stream restoration projects to improve fish habitat has heightened the need for consistent protocols for volunteer water monitors, and the Council is now working toward that goal. More comparable, higher quality data from volunteers will increase the acceptability of their work.

6. Federal agencies also monitor water quality in Washington. US Geologic Survey has gathered considerable water quality information in Washington. The National Water Quality Assessment (NAWQA) program has provided reports on:

- Pesticides in Public Supply Wells in Washington State
- Possible Mercury Contamination of Walleye from Lake Roosevelt
- Predicting Ground Water Vulnerability to Nitrate in the Puget Sound Basin
- Central Columbia Plateau (CCPT) National Water Quality Assessment
- Puget Sound Basin NAWQA
- Irrigation and Surface Water Quality in the Quincy and Pasco Basins, Washington
- Pesticides in Selected Small Streams in the Puget Sound Basin
- Pesticides and Volatile Organic Compounds in Ground and Surface Water of the Palouse
- Pesticides Found in Ground Water below Orchards in the Quincy and Pasco Basins
- Watershed and River Systems Management Program: Application to the Yakima River Basin, Washington

USGS anticipates that it will continue with NAWQA studies in Washington, with increased coordination under this nonpoint management plan.

Other federal agencies that monitor Washington waters are the US Forest Service, Environmental Protection Agency, and the Fish and Wildlife Service. An MOA will facilitate greater coordination of monitoring efforts.

NPDES Monitoring

Many local governments in Washington State are required to monitor surface water by NPDES permits issued for wastewater treatment plant discharges and/or phase 1 stormwater discharges. Phase 2 NPDES will require monitoring for all local governments with stormwater discharges in urbanized areas. Furthermore, the 4(d) rule for Chinook salmon to be issued by National Marine Fisheries Service (NMFS) will likely also increase monitoring requirements by local governments.

Environmental Information Management (EIM)

A relatively new system, the Environmental Information Management System (EIM), was built to fill a growing need to collect and access information from various agencies and outside groups, as well as to assist in the sharing of data between Ecology and external users. It is currently available to Ecology staff with plans to place the system on the Web. EIM was designed to contain ambient environmental monitoring and natural resource information, in a format that is widely accessible. EIM captures information on environmental measurements and sampling results, along with a variety of information about those measurements, including location of the station where a sample was collected and the project under which it was originally collected.

EIM can store a wide range of data and then integrate different data sets in a variety of ways to generate reports from a project or monitoring station, or about a specific chemical or geographic area. For example, EIM can tell you what projects have been undertaken to characterize the water quality of a watershed, such as the Cedar River/Lake Washington system; where the monitoring stations are located in that watershed; and what monitoring results exist for pollutants of interest. Data can be accessed to help with trend or other analysis. In the future, individuals or groups will be able to use the Internet to search for data on a particular topic or watershed. EIM makes environmental data more useful and accessible for Ecology staff, and ultimately outside researchers and anyone else needing data.

In addition to monitoring data, EIM stores background information (metadata) such as information about the project, the site, or the quality assurance project plan**.**